

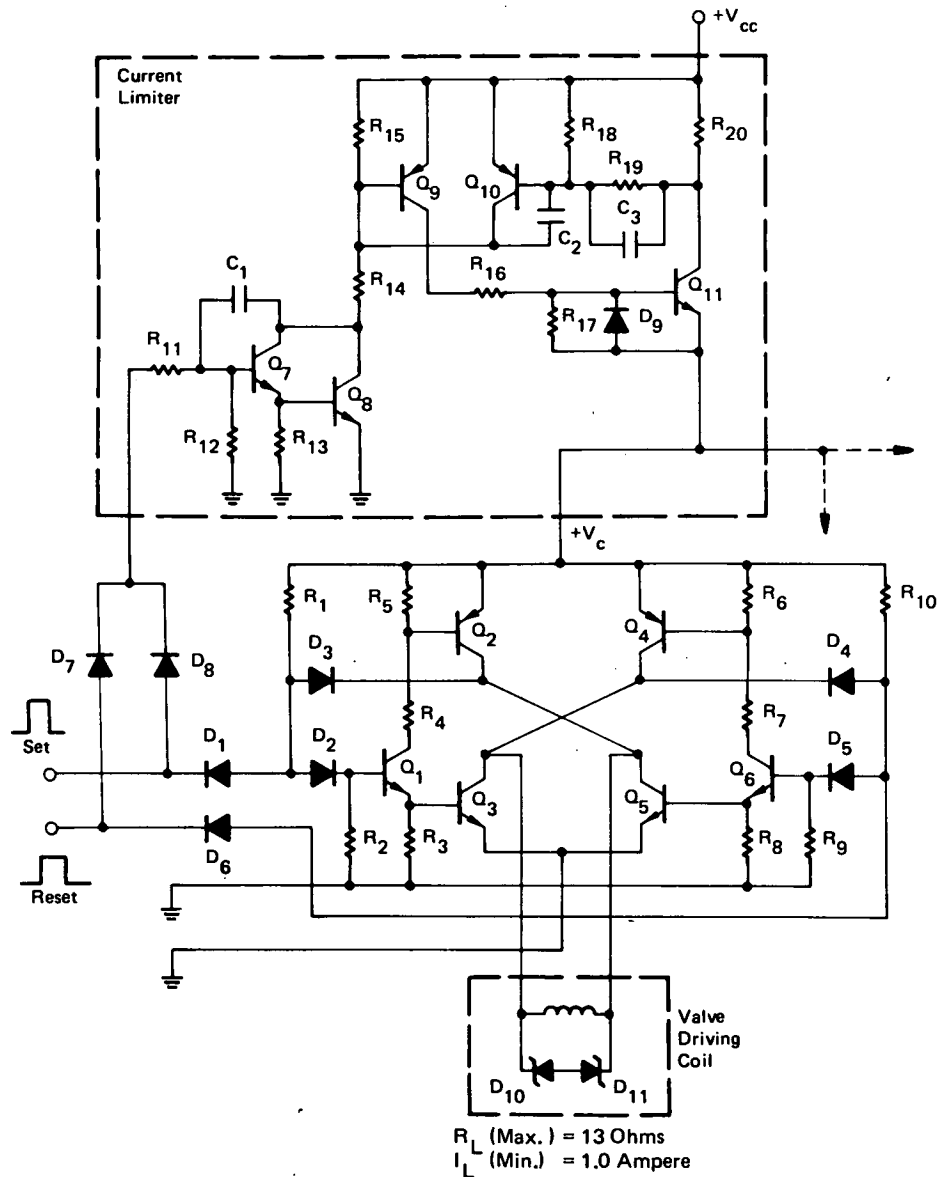
# NASA TECH BRIEF

## NASA Pasadena Office



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### Fail-Safe Bidirectional Valve Driver



Bidirectional Valve Driver

(continued overleaf)

**The problem:**

Bidirectional valve driver circuits which operate from a single power supply are subject to damage when the load is shorted or shorted to ground.

**The solution:**

Cross-coupled diodes are added to a commonly used bidirectional valve driver circuit to protect the circuit and power supply.

**How it's done:**

When the set/reset command [ $+2.7$  volts (peak), 20-millisecond duration] is received, the current limiter is turned on and applies power ( $+V_c$ ) to the valve driver. The current limit is set to 1.3 amperes and protects the power supply ( $+V_{cc}$ ) in the event of a short circuit (see figure). The cross-coupled diodes  $D_3$  and  $D_4$  prevent simultaneous execution of the set and reset commands.

Valve actuation is prevented in the event the actuator coil is shorted to ground; under normal operation, the coil is isolated from ground. Should the coil become grounded, cross-coupling diode  $D_2$  prevents valve actuation by clamping point A. In addition, when the coil is shorted, transistors  $Q_2$  and  $Q_3$  are protected by holding  $Q_2$  off. However, with  $R_5$  properly adjusted,

$Q_3$  will be turned on just enough to drive  $D_3$  and  $R_1$  ( $Q_3$  collector current) while maintaining  $Q_2$  in an off state.

**Notes:**

1. This circuit may be used in systems requiring fail-safe bidirectional valve operation, particularly in chemical- and petroleum-processing control systems and computer-controlled hydraulic or pneumatic systems.
2. Requests for further information may be directed to:  
Technology Utilization Officer  
NASA Pasadena Office  
4800 Oak Grove Drive  
Pasadena, California 91103  
Reference: TSP73-10450

**Patent status:**

NASA has decided not to apply for a patent.

Source: Hisashi Fujimoto of  
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